Remarks:

Claim 3 has been amended by inserting the temperature at which the polyvinyl alcohol is dissolved in water. This feature is supported by original claim 16 and by the fourth complete paragraph on page 22 of the present specification. The feature that the total amount of tetrahydrofurfuryl alcohol in the feedstock is from 40 to 50% is taken from original claim 5 which is canceled by the present instructions. Claim 3 has also been amended by amplifying the terminology "the mixed" to clarify that it is a mixed liquid (X)(Y) which was formed by mixing the uranyl nitrate mixture (X) with the polyvinyl alcohol solution (Y).

Claims 8 and 15 are rejected under 35 USC 112, second paragraph.

Claim 8 was objected to on the ground that the limitation "...decreases to 50°C ..." has insufficient antecedent basis because there is no heating involved in claim 3 (from which claim 8 depends). Claim 3 has been amended to specify that the preceding step in the claimed process is at a temperature of 75°C or more, thereby providing antecedent basis for the temperature feature of claim 8.

Referring to claim 15, the Office Action suggested to change "...from 6 to 9 mass% of an aqueous polyvinyl alcohol..." to "...from 6 to 9 mass% of PVA in the feedstock liquid...". This

suggested amendment is not made because claim 15 is directed to a method of preparing a polyvinyl alcohol solution which is used in the preparation of feedstock liquid for production of ammonium diuranate articles. It is not directed to a method of preparing a feedstock liquid. Claim 15 is amended herein to clarify that the 6 to 9 mass% of PVA is in the aqueous polyvinyl alcohol solution. This feature is supported by the disclosure on page 22 of the specification, second full paragraph (which corresponds to paragraph [0105] in the publication of the present specification US 2007/0178036 A1). It is respectfully submitted that amended claim 15 is not indefinite.

Claims 3-11 and 18-22 were rejected under 35 USC 103 over the Hideji et al JP 05-279043 A (hereinafter "Hideji"). Claim 3 is amended to incorporate the feature of original claim 5 which is now canceled.

The Office Action states

> "Regarding claim 5 and 18, although Hideji does not specifically teach the concentration of THFA, it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art, therefore, the invention as a whole would have been *prima facie* obvious to one of ordinary skill in the art at the time the invention was made."

The Declaration of Mr. Masashi Takahashi attached herewith provides data that tetrahydrofurfuryl alcohol, which will be abbreviated to THFA hereinafter, in a concentration of 40 to 50 vol.% is critical to produce fuel kernels without inside defects. When the concentration of THFA is less than 40 vol.%, from 1% to about 30% of the produced fuel kernels have inside defects. As discussed in the Declaration, fuel particles having fuel kernels with defects inside them are prone to leak fission gas through the coating layer. Once fission gas leaks through the coating layer out to the nuclear reactor, it quickly expands in the reactor. If many fuel kernels with inside defects are fed to the nuclear reactor, the safety system thereof may be activated and the reactor may be shut down. The shutdown of a nuclear reactor means that the high-temperature gas-cooled reactor can no longer serve its purpose, such as power generation or hydrogen production. A shutdown of a nuclear reactor usually is publicized in the newspapers and on websites, which often excites uneasiness in the residents near the nuclear plant about safety thereof.

Although Hideji refers to THFA, they mention it just as an example of a photodecomposition terminator. The photodecomposition terminator serves to prevent photodecomposition of the binder resin in the presence of uranium

that works as a catalyst. See paragraph [0011] of the Hideji document. Since such a photodecomposition terminator is not very important, Hideji discloses nothing about its concentration. In fact, THFA is not used in the working example of the Hideji reference, which is normally considered to disclose the best embodiment of the invention.

On the other hand, Mr. Masashi Takahashi, the inventor of the present application, discovered that THFA affected the inside defects and sphericity of the produced fuel kernels. he also revealed that the use of THFA in the specified concentration was critical as proven by the attached Declaration.

Although a researcher who studied the disclosure of Hideji might use a small amount of THFA as a photodecomposition terminator when he/she prepares a feedstock liquid for production of ammonium diuranate particles, which will be changed to fuel kernels used in a nuclear reactor, the use of THFA in such a small amount may lead to shutdown of the nuclear reactor.

Also paragraph [0052] of the publication of this application (page 13, bottom paragraph) discloses that uranium dioxide fuel kernels with good sphericity can be produced with good reproducibility when the amount of THFA is within the range from 40 to 50% by volume, while uranium dioxide fuel kernels with poor sphericity may be produced when the amount of THFA is outside the

range. Mr. Takahashi provided us with the following additional explanation about the sphericity.

A coating layer is deposited on the surface of each fuel kernel after the production of fuel kernels. When fuel kernels with poor sphericity are produced, it is very difficult to deposit a coating layer on the surfaces of the fuel kernels in such a way that the produced fuel particles are in the shape of a true sphere. the obtained fuel particles, which are covered with the coating layer, are finally molded to fuel compacts or fuel pebbles, and sold as a nuclear reactor fuel. The final process includes mechanically compacting the fuel particles. There is a higher probability that fuel particles with poor sphericity will be broken during the compacting step than the probability that fuel particles with a good sphericity will be broken during the same step. In order to produce fuel particles with a low probability of the breaking, he thinks that it is important to prepare fuel kernels with good sphericity.

It is respectfully submitted that Hideji's disclosure of the optional use of THFA as a photodecomposition terminator would not direct a worker in this field to use large amounts of THFA (40 to 50%) to obtain a feedstock which produces spherical fuel particles which have few if any internal defects. It is respectfully submitted that claims 4, 6-11, 19, 21, 23-25 and 26

which depend from amended claim 3 directly or indirectly are not obvious in view of the Hideji disclosure for the same reasons that amended claim 3 is not obvious from the Hideji disclosure.

Claims 12-14 are rejected under 35 USC §103(a) as being unpatentable over Hideji further in view of Larson et al US 5,514,306 (hereinafter "Larson") and Krishnamurthy US 4,778,665 (hereinafter "Krishnamurthy").

Larson teaches using excess of HNO_3 in column 5, lines 12-13. When the molar ratio of HNO_3 to U_3O_8 is greater than 8, the molar ratio of HNO_3 to uranium is greater than 2.67. On the other hand, amended claim 12 requires that the molar ratio (A/B) of nitric acid (A) to uranium (B) be from 2.3 to 2.5. The basis for this range can be found in paragraph [0060] of the US 2007/0178036 A1 publication (page 15, lines 14-15).

As stated in paragraphs [0011] (page 4, line 22 to page 5 line 7) and [0014] (page 7, lines 17-22), one of the objectives of the invention is to provide a method of preparing a uranyl nitrate solution, the method being capable of reducing the burden on the environment. The use of an excess amount of nitric acid means that the nitrogen content in the waste fluid is increased inevitably, which results in an increased burden on the environment.

Larson teaches that the reaction between U_3O_8 and HNO_3 takes place according to the formula:

$$U_3O_8 + 8HNO_3 \rightarrow 3UO_2(NO_3)_2 + 2NO_2 + 4H_2O$$

The stoichiometric molar ratio of HNO_3 to uranium is 2.67, or that of HNO_3 to U_3O_8 is 8 in this reaction. Therefore, if nitric acid in an amount less than 8 mol is used to 1 (one) mol of U_3O_8, part of U_3O_8 remains unreacted.

In order to reduce the nitrogen content in waste fluid, the present inventor made U_3O_8 react with HNO_3 according to both of the following formulae:

$$U_3O_8 + 8HNO_3 \rightarrow 3UO_2(NO_3)_2 + 2NO_2 + 4H_2O$$

$$3U_3O_8 + 20HNO_3 \rightarrow 9UO_2(NO_3)_2 + 2NO + 10H_2O$$

The stoichiometric molar ratio of HNO_3 to uranium is 2.22 in the lower formula. the combination of the two reactions reduces the molar ratio of HNO_3 to uranium to less than 2.67.

Larson does not disclose the reaction according to the lower formula. Besides, they recommend using an excess amount of nitric acid, which means that they neither teach reduction in the nitrogen content nor suggest the reaction according to the lower formula. The Larson document does not disclose use of THFA, either.

Krishnamurthy generally teaches abatement of nitrogen oxides. However, this reference has nothing to do with reactions to produce nuclear reactor fuel.

It is respectfully submitted even when the three references are combined in the manner relied upon in the rejection, the combined teachings do not render obvious applicant's claimed invention. Claim 12 depends from amended claim 3 and there are no teachings in these three references which would render obvious the subject matter of amended claim 3 for the reasons discussed hereinbefore. The deficiencies of Larson as a reference are pointed out hereinbefore. Additionally, neither Larson or Krishnamurthy disclose the use of THFA. It is therefore respectfully submitted that amended claim 12 and claims 13-14 are not rendered obvious by the combined disclosures of the three references.

The rejection based upon the three references is also respectfully traversed on the ground that there are no teachings in these references which would direct workers in this field to combine the references in the manner relied upon in the rejection.

Claims 15-17 are rejected under 35 USC 103 over the Hiroji JP 6-66756 A (hereinafter "Hiroji"). The Office Action, page 6, second paragraph states that the amount of PVA in the Hiroji

aqueous PVA solution "...is in the range of 9 to 11 weight%" and that "THFA (2 weight %) is added if necessary". It is respectfully submitted that this is not a correct characterization of the Hiroji disclosure. Attached hereto is a partial English language translation of JP 6-66756 A (referred to herein as "Hiroji"). The partial translation sets forth an English translation of paragraphs [0006], [0011], [0014], [0015](iv) and [0016]. As discussed hereinafter, Hiroji teaches a paste.

Paragraph [0006] discloses a paste including 20-30 parts by weight of water, 9-11 parts by weight of polyvinyl alcohol, 2-3.5 parts by weight of acetylene black, 1.0-2.8 parts by weight of powdery graphite, 2.0-3.0 parts by weight of boron nitride, 15-20 parts by weight of tetrahydrofurfuryl alcohol, and 1.0-2.0 parts by weight of n-octyl alcohol. Therefore, the percentage of polyvinyl alcohol in the paste is from 17.9-29.7% by weight, which is much larger than the limitation in claim 15.

The importance of the specified range is shown by the data included in the present application. Please see comparative example 2 in paragraphs [0153] and [0154] of the publication of the present application (page 32, line 8). In this comparative example, the PVA content of the aqueous PVA solution was 9.1% by

mass, which was slightly larger than the upper limit 9.0% by mass.

The results of comparative example 2 are discussed in paragraph [0154]. Ammonium diuranate particles obtained from the feedstock liquid that included the aqueous PVA solution had defective interior structures.

Please compare this comparative example with working example 2. Comparative example 2 is different from working example 2 only in the amount of PVA; the PVA content of the aqueous PVA solution of working example 2 was 7% by mass. Ammonium diuranate particles produced in this working example had a uniform inside structure. See paragraph [0147], page 30, third paragraph.

As noted hereinbefore, fuel kernels with inside defects produced from ammonium diuranate particles with defective inside structures might lead to a shutdown of a nuclear reactor.

The Office Action refers to paragraphs [0011] and [0015] of the Hiroji document. Paragraph [0011] states that ion-exchanged water in an amount from 50 to 150 parts by weight and polyvinyl alcohol in an amount from 9 to 11 parts by weight may be introduced in the container. Some 70% of this large amount of io-exchanged water is removed in the next step so that the final product includes 20-30 parts by weight of the ion-exchanged water. See paragraph [0014]. Also, in paragraph [0015], it is

stated that 2.0 parts by weight of tetrahydrofurfuryl alcohol is added to the concentrated mixed liquid having been prepared in the kneader in the concentrating step. The numeral "2.0" is an obvious typographical error. It should be read "20". In all the other parts of the disclosure, the amount of THFA is from 15 to 25 parts by weight.

Claim 15 specifies a method of preparing a PVA solution. The intended use of the solution is as a raw material of a feedstock liquid for production of ammonium diuranate particles. On the other hand, the Hiroji reference is directed to a paste for a moisture sensitive resistor or dew sensors and has nothing to do with a feedstock liquid for production of ammonium diuranate particles. As discussed above, the amount of PVA included in the aqueous PVA solution of claim 15 is different from that of PVA included in the past of Hiroji. Hiroji teaches nothing about ammonium diuranate particles for nuclear reactor fuels: He discloses only a paste for a moisture sensitive resistor of dew sensors.

It is respectfully submitted that workers in the field of the present invention would not look to the Hiroji disclosure of a paste for an unrelated purpose (dew sensors) for a base composition and then experiment with the proportion of PVA to form a solution (instead of Hiroji's paste) and find that this

solution is useful for preparing a feedstock liquid for production or ammonium diuranate particles having improved properties. It is respectfully submitted that applicant's claims 15-17 are not obvious in view of the Hiroji disclosure.

Reconsideration of the rejection and allowance of the claims is solicited.

If the Examiner has any questions or suggestions, a telephone call to the undersigned attorney is invited.

Respectfully submitted,

HERBERT GOODMAN
Reg. No. 17,081

Frishauf, Holtz, Goodman
& Chick, P.C.
220 Fifth Avenue - 16th Floor
New York, NY 10001-7708
Telephone: (212) 319-4900, Ext. 216
Facsimile: (212) 319-5101

HG/fs/lpv
Encs: (1) Dr. Takeshi's DECLARATION dated December 22, 2008
(2) JP 6-66756 A Partial English Translation